THE
YEAR-BOOK OF FACTS
IN
Science and Art:

EXHIBITING

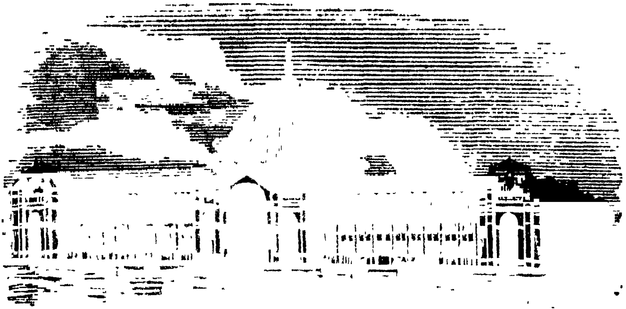
THE MOST IMPORTANT DISCOVERIES AND IMPROVEMENTS OF THE PAST YEAR;

IN MECHANICS AND THE USEFUL ARTS; NATURAL PHILOSOPHY;
ELECTRICITY; CHEMISTRY; ZOOLOGY AND BOTANY; GEOLOGY
AND MINERALOGY; METEOROLOGY AND ASTRONOMY.

BY JOHN TIMBS, F.S.A.

AUTHOR OF "CURIOSITIES OF SCIENCE," "THINGS NOT GENERALLY KNOWN," ETC.

> "Were I to enlarge on the relation of the achievements of science to the comforts and enjoyments of man, I should have to refer to the present epoch as one of the most important in the history of the world. At no former period did science contribute so much to the uses of life and the wants of society."—*Address of Mr. Fairbairn, C.E., President of the British Association, at Manchester*, 1861



Building for the [illegible] Exhibition, 1862.—(See page 13.)

LONDON:
LOCKWOOD AND CO., 7, STATIONERS' HALL COURT.
MDCCCLXII.

and do not explain the rapid changes in intensity which follow the appearance of clouds in the sky, and rapid variations of temperature. The question thus raised deserves serious attention, not merely on account of its scientific importance, but also because it may be of great practical utility, by enabling us to foretel atmospheric changes. These phenomena are only beginning to be studied by scientific men.

THE GREAT COMET OF 1861.*

On Sunday evening, (June 30,) about ten o'clock, a Comet of extraordinary splendour suddenly appeared. At the same hour it became visible at Rome, Lisbon, Paris, and London. The comet is, in fact, a very small body—the diameter of the nucleus, according to Mr. Hind's measurement, being no more than four hundred miles. Its excessive brilliancy is due to its nearness to the earth. When first seen, it was no more than thirteen millions of miles from this planet—and this evening (Saturday, July 6,) it will be under twenty-three millions from us. The rate at which it is moving from our point of vision is nearly thirty miles a second—more than a hundred thousand miles an hour. So small an object will very soon get beyond our view. French papers say that this is the comet of Charles the Fifth, which has been expected about this period; but this, it appears, is a mistake. Mr. Hind states that "the comet arrived at its least distance from the sun about one o'clock on the morning of June 10, in heliocentric longitude 244° 35′, being then separated from him by 76,000,000 miles. It crossed the plane of the Earth's orbit from the south to the north side in longitude 279° 1′ on June 28, in a path inclined 85° 58′ to the ecliptic. The true orbital motion is direct."

The following communication on the subject is also from the *Athenæum*:—

"Cranford, July 4, 1861.

"Although I watched diligently for a break in the clouds, on Monday, the 1st instant, I did not get a sight of the comet, and it was on the 2nd, at 7 minutes past nine o'clock, that I first perceived the comet. The head of the comet was then as bright as a star of the second magnitude, but appeared to the naked eye fully as large as Jupiter, which was visible near the western horizon; the head was almost vertically over Omicron, in the Great Bear's nose, and during the night retreated almost in the apparent direction of the tail. At about 11 o'clock the tail could be traced for fully ninety degrees; it consisted of a curved brush of light bending over to the direction of the two pointers. The light of this short brush was extremely diffuse on the western side; towards the eastern side a long narrow ray shot out, extended over the zenith, and passed through Draconis, where it again enlarged, and became very faint, but could be traced several degrees beyond an imaginary line, which would join *α* Lyræ and Arcturus. The appearance of the comet in my second Newton's reflector was on the 2nd inst. very like a broken fan, supposing the two lower ribs to be considerably curved, and the height of the fan small in comparison with its width. The nucleus, which was situated at the joint of the ribs, was extremely small and elliptical, the longer axis of the ellipse being in the direction of the length of the tail. Last night the fan-shape of the coma was much more distinct and more generally filled with light; but there were several irregular brighter rays within it. The light of the coma and envelope is much more diffuse and less brilliant than Donati's comet of 1858. I made an attempt on the 2nd to obtain a photograph of the comet in the focus of my reflector; but not the slightest impression was produced by an exposure of two minutes, although a fixed star was clearly depicted. Yesterday, the 3rd, I made several attempts to photograph the comet by means of Rosse's No. 3 portrait lens mounted on the top of my telescope, and carried round by clockwork—not the slightest trace of the comet was depicted in fifteen minutes, although the fixed stars were depicted. As Donati's Comet was photographed by similar means in seven seconds (not by myself), it follows that the present Comet is considerably less actinic than Donati's.

---

* From the *Athenæum*, July 6, 1861.

"WARREN DE LA RUE."

We have seen other attempts made to photograph the comet, but without success. The contiguous stars left a strong impression on the prepared glass, but the comet itself left no trace of its presence.

Paris.—M. Le Verrier has addressed the Paris Academy of Sciences as follows, on the Comet:—"We do not know this comet; it is the first time it visits us, and those who have endeavoured to predict its course, determine its distance from the earth, and measure its tail, have either deceived themselves or the public. Three elements are necessary to calculate the orbit of a comet: first, the exact position of the star; then its velocity; and, lastly, the variation of velocity produced by the mass of the sun. I caused the comet to be observed on the 30th of June, and then on the night of the 1st and the morning of the 2nd inst., in order to determine the variation of velocity. These three observations would have followed too closely upon each other for the calculation to be attempted, were it not that the comet moves very rapidly. On the 3rd, at 10 A.M., M. Lévy brought me the result of his calculations, and we then obtained an insight into the orbit of the comet. Mr. Hind has since sent me the orbit calculated by the English astronomers, which perfectly agrees, in all but two minutes, with our results. It is now positive that this is not Charles V.'s comet; and, moreover, it resembles none of those already observed. This circumstance will contribute not a little to throw confusion upon the little we know of these erratic bodies. I cannot yet say whether this comet is periodical or not; its orbit up to this day has been too cursorily determined to enable us to pronounce it elliptical, parabolical, or even hyperbolical. At any rate, appearances are against its return, for the orbit is nearly perpendicular to the plane of the ecliptic, while those of periodical comets usually form a very small angle with that plane. It is only now we can determine the distance of the comet from the earth, and the length of its tail. On the 30th of June the line joining the centre of the sun with that of the comet made an angle of four degrees with that joining the centres of the sun and earth, the length of which is known. The angle which this line formed with the visual ray, drawn from the eye of the observer to the centre of the comet, was 24°. The triangle thus formed may, therefore, be calculated, and it gives us the distance of the comet from the earth, amounting to between 6,000,000 and 7,000,000 of leagues (about 17,000,000 of miles English). The length of the tail might be similarly calculated. The comet is rapidly moving away from us, and it is therefore not surprising that its brilliancy has diminished. On the 10th it will be equally distant from the sun and earth; we shall soon lose sight of it, and astronomers only will be able to follow it for a month longer. It presents a singular peculiarity. M. Chacornac has studied the nucleus with one of M. Foucault's telescopes of a diameter of forty centimètres; instead of its being hollow like the half of an egg-shell, like most of the comets already observed, it presents the appearance of a sun composed of fireworks, the bent rays of which burn in the same sense. Moreover, the comet has not drawn nearer to the sun. These are all circumstances calculated to introduce great complications into the theory of comets."

The Comet as seen at Rome is described by Father Secchi in a communication to the French Academy. The most interesting fact which he relates is that on the 30th of June the polarization of the light of the tail and of the rays near the nucleus was very strong, and could be distinguished by the polariscope in bands, while the nucleus itself presented no traces of polarization, even with Arago's polariscope with a double coloured image. But, however, on July 3, and the following days, until the 7th, the nucleus, in spite of its extreme diminution, exhibited sensible indications of polarization. Father Secchi considers this fact of great importance, since it thereby appears that the nucleus in the first days transmitted its own light, perhaps on account of the incandescence to which it was raised by its near proximity to the sun. M. Poey, the meteorological observer at the Havannah, Cuba, states that he has hundreds of times proved by his experiments that the polarization of luminous bodies in the celestial space is more or less combined with atmospheric polarization, especially so with the polarization of the clouds, except when they are black or stormy. This may combine with the light of a comet by reflection, but it is easy to eliminate it by means of Nicol's prism or a tourmaline.

At Peru (from a local paper, the *Bolsa*):—

On the 9th inst. there appeared within the horizon of this city a beautiful comet, with a nucleus of the size of a star of the second magnitude, a very distinct coma, and a tail about 2 degrees wide, extending diagonally across the heavens over a space of about 30 degrees. By observations taken on the 14th and 15th, it rose the first day at 4 26 a.m., the second at 4 24, the first appearance of the tail taking place 40 minutes previously. On the 14th its position was in 24 degrees south, *i.e.*, outside the Ecliptic, and close to the Tropic of Capricorn, occupying the constellation "River Eridanus," the tail extending as far as the star of the first magnitude "Achernar." On the 16th it first appeared in 22 degrees, showing that its course is towards perihelion. This comet bears a great resemblance to that of 1680, the return of which was predicted by Newton for 2255, and its position is identical with that occupied by the great comet which was visible in this city in March, 1843.

Arequipa, June 17.

North America (from *Silliman's Journal*).—On Sunday evening, June 30th, between eight and nine o'clock, there was observed at New Haven, in the northern part of the heavens, in an opening between the clouds and at an elevation of about ten degrees, a nebulous body of unusual brilliancy. Its appearance was similar to that of the planet Jupiter shining through a thin mist; and it was nearly as conspicuous an object in the heavens as Jupiter, although this was due not only to the intensity of its light, but partly to its extent of surface, its apparent diameter being about equal to that of the full moon. It was at once suspected that this body was a comet; but this conclusion was adopted with some reserve, on account of the unusual brilliancy and sudden apparition of the meteor. This light was soon concealed by a cloud; but about half an hour later, a larger opening in the clouds disclosed the tail of the comet, in the form of a bright streamer, with sides nearly straight and parallel, and pretty sharply defined. The head of the comet was now invisible; but a little later both head and tail were seen simultaneously, forming together one of the most brilliant comets of the last fifty years, and astonishing every one by the suddenness of its development.

On Monday it was ascertained that on Saturday evening several individuals had noticed in the north a bright streamer, rising to a great height above the horizon, and it was at once concluded that this was the tail of the same comet. The daily newspapers report, that the head of the comet was seen on Saturday evening at Columbus, in Ohio; but it is not known that any one made any accurate determination of its place.

Mr. Bond, the Director at the Observatory of Harvard College, Cambridge, Mass., says, "The suddenness of the apparition of the comet in northern latitudes was one of the most impressive of its characteristics. On the 2nd of July, after the twilight had disappeared, the head, to the naked eye, was much brighter than a star of the first magnitude, if only the effective impression be taken into account, although as to intensity it was far inferior to *α* Lyræ, or even to *α* Ursæ Majoris. I should describe the head as nearly equal in brightness to that of the great comet of 1858, between the 30th of September and the 5th of October; it should be considered however that the present comet was better situated, from its higher position above the horizon at the end of twilight.

"The aspect of the tail suggested a resemblance to the comet of March, 1843. It was a narrow, straight ray projected to a distance of one hundred and six degrees (106°) from the nucleus, being easily distinguishable quite up to the borders of the milky way."

It is obvious from the elements computed by Professor Hubbard, of the U. S. Naval Observatory, Washington, that this comet is not the same as the comet of 1556 (called Charles the Fifth's Comet) whose return has been anticipated for several years; nor do these elements bear any resemblance to those of any comet in the published catalogues. We must conclude, then, that this comet is a new one, whose orbit has never before been computed.

The nucleus admitted of very precise observations; indeed, it is a curious fact, that it would be quite possible, by means of proper comparisons with neighbouring stars, to obtain the differences of terrestrial longitudes of the principal points at which it was observed with a degree of precision only surpassed by the more refined methods known in astronomy.

The near approach of the present comet to the earth, and the sharply defined point of its nucleus, illustrates the practicability of a method of determining the solar parallax with perhaps greater exactness than can be attained by any other means. Many comets have stellar points for their nuclei, visible in the larger telescopes, which admit of as accurate comparisons with neighbouring stars as is practicable in measurements among the stars themselves. Many such have appeared within the last fifteen years. Suppose such a comet to be suitably placed so as to be observed simultaneously in different quarters of the globe, when at a distance from the earth of less than one-twentieth of the sun's distance: under favourable circumstances it would not be hazarding too much to say, that in the course of its apparition the probable error of the solar parallax could be reduced within smaller limits than is possible by means of transits of Venus or of any other method. Such an opportunity might possibly afford an improved value of the mass of the earth.

From the elements computed at the observatory, by Messrs. Safford and Hall, the diameter of the nucleus may be variously estimated at from 150 to 300 or 400 miles. On July 2nd the breadth of the head at the nucleus was 156,000 miles, the height of the inner envelope 11,500 miles, and the length of the tail about 15,000,000 miles.

The reports current of the identity of the comet with those of 1264 and 1556, are without any foundation.

THE DISCOVERY OF A NEW PLANET,

By M. De Gasparis, at Naples, on Feb. 10, was announced at the meeting of the French Academy by M. De Beaumont. It has the brilliancy of a star of the tenth magnitude.

THE PLANETARY SYSTEM.

M. Le Verrier, in a letter to Marshal Vaillant, states the inferences which follow from our present theories regarding the sun, Mercury, Venus, the earth, and Mars. M. Le Verrier arrives at the conclusion that there are three rings of matter revolving round the sun; the first, between the sun and Mercury; the second, near the earth, including aerolites, or meteoric stones and shooting stars; and the third, between Mars and Jupiter, consisting of the small planets. His conclusions are as follows:—First. Besides the planets Mercury, Venus, the Earth, and Mars, there exists between the sun and Mercury a ring of asteroids, whose total mass is about equal to the mass of Mercury. Second. At the same distance from the sun as the earth, there exists a second ring of asteroids whose mass exceeds the tenth-part of the mass of the earth. Third. The total mass of the small planets situated between Mars and Jupiter, exceeds one-third of the mass of the earth. Fourth. The masses of these two last groups are complements to each other. Ten times the mass of the group near the earth, also three times the total mass of the small planets between Mars and Jupiter, form a sum equal to the mass of the earth. The last conclusion depends upon the distance between the earth and the sun, as ascertained from the transits of Venus, and the measurement of the distance is generally admitted by astronomers to be very accurate.

ECLIPSE RESULTS.

PROFESSOR FARADAY, in explaining to the Royal Institution Mr. Warren De la Rue's Eclipse Results, has exhibited magnified images of them by aid of the electric lamp, displaying the extraordinary protuberances, clouds, and other appearances which the sun presented in profile when his luminous disc was hidden from sight by the moon. Professor Faraday especially dwelt on the advantages of these photographs in producing images of those rays of light in the luminous phenomena which are invisible to the human eye; and, by way of evidence, had a photograph taken of the coloured rays of the spectrum of the electric light, which showed that the violet and invisible rays have a far more powerful photographic action than the brighter colours. Professor Faraday referred to the varying opinions of philosophers respecting the cause of the luminous prominences, and said that it seemed highly probable that they belonged to the sun itself.

THE RING OF SATURN.

WITH reference to the observation of Mr. Warren De la Rue of peculiarities in the shadow of the Ring of Saturn passing the ball, Mr. Lassell, the Liverpool astronomer, has printed in the *Astronomical Society's Monthly Notices* the following note of the interesting phenomena of an observation made by himself when the ring was in nearly the same position:—"Aug. 3, 1849. The peculiar feature of this unequalled view was that the most minute, but extremely black, shadow of the ring upon the ball, was evidently knotted or notched, conveying the idea of mountains upon the plane of the ring, intercepting portions of the thin line of shadow, and almost breaking it up into a line of dots." Captain W. S. Jacob, of Hartwell, who observed the phenomena on May 19 last, is inclined to attribute them to a variation in the shade or tone of the shadow, by which the darker portions appeared to project beyond the rest.

THE MOVEMENTS OF SIRIUS (THE DOG STAR)

HAVE been investigated by M. Calandrelli, director of the Pontifical Observatory at Rome, founded and liberally maintained by Pius IX., who has purchased for it valuable and expensive apparatus. M. Calandrelli thinks the anomalies of Sirius are explicable by a peculiarity in its movement, without having recourse to the hypothesis of a large satellite. M. Le Verrier, after reading the above communication, referred to the circumstance of Pius VII. and Pius IX. having both munificently supported the study of astronomy, and added satirically, "This is the way in which the Pontifical Government hinders the progress of the natural sciences!"

THE WEATHER AND THE SCINTILLATION OF THE STARS.

IN a communication recently made to the Paris Academy of Sciences, by M. Liandier, it is stated that the occurrence of storms and similar changes in the Weather may be predicted from twenty-four to twenty-eight hours beforehand, by observing the Scintillation of the Stars, as shown in a telescope. The image of a star in the object-glass is, in fact, a mirror which reflects the condition of the atmosphere through which the rays pass. The best indications of the state of the upper strata of the atmosphere are said to be obtained from a well-defined image of a star of the first magnitude, when near its point of culmination. At first, there may be seen, moving apparently in all directions across the image, vibrations or waves more or less brilliant, and obscure or coloured. By examining these waves carefully, it will be perceived that they cross the disc in one direction, thus showing the direction in which currents of air are flowing at that moment in the upper regions of the atmosphere. For instance, when these undulations pass over the image of the star from the north-east, they indicate that winds from that quarter are blowing at some distance above the earth, and consequently the approach of dry weather; on the contrary, when the waves cross the disc of the star's image from the south-west, they foretel rain. The telescope may thus sometimes serve the same purpose as a weather-glass.

METEOR IN SOUTH AUSTRALIA.

PROFESSOR NEUMAYER, Director of the Magnetic Observatory at Melbourne, has, in consequence of a question asked in the Assembly, published the observations made with reference to a Meteor seen on March 4, 1861. The shape of the meteor seems to have been like a cone or wedge, the base being foremost. The light was very intense, resembling that of melting iron. It left behind a train of light resembling the tail of a comet. At one place a sulphuric smell was observed. It was first seen about 9.38 A.M., moving from S. 54° E. to N. 54° W. It first appeared in the south-west when observed in Geelong. Then it seems to have reached the earth in a place some five miles towards the north of Ballarat, and also in a locality some four miles towards the west of Ararat. These facts would lead us to believe that it changed its course after having been deflected by the ground near Mount Hollowback, which place seems to have been marked by a deep furrow of twelve yards. There was no magnetic disturbance at the time. The state of the weather was peculiar, and had been exceedingly oppressive for some days previous. The sky was overcast at the moment of the occurrence, the temperature was 83°, and the wind very slight from the N.N.W. The lowest reading of the barometer since the 19th of February was on the day of the occurrence at 3 P.M., viz. 29·446 inches.

RAIN ON ST. SWITHIN'S DAY.

THE value to be placed upon the popular notion that if it rains upon the 15th of July, it will do so for the 40 succeeding days, may be learnt from the following facts, from the Greenwich observations of the last 20 years. It appears that St. Swithin's Day was wet in 1841, and there were 23 rainy days up to the 24th of August; 1845, 26 rainy days; 1851, 13 rainy days; 1853, 18 rainy days; 1854, 16 rainy days; and in 1856, 14 rainy days. In 1842 and following years, St. Swithin's Day was dry, and the result was—in 1842, 12 rainy days; 1843, 22 rainy days; 1844, 20 rainy days; 1846, 21 rainy days; 1847, 17 rainy days; 1848, 31 rainy days; 1849, 20 rainy days; 1850, 17 rainy days; 1852, 17 rainy days; 1855, 18 rainy days; 1857, 14 rainy days; 1858, 14 rainy days; 1859, 13 rainy days; and in 1860, 29 rainy days. These figures show the superstition to be founded on a fallacy, as the average of 20 years proves rain to have fallen upon the largest number of days when St. Swithin's Day was dry.

THE PRODUCTION OF MIST

Is the subject of a note by the veteran Dr. Davy in the *Edinburgh New Philosophical Journal.* The cause usually assigned for Mist is the access of cold air and its admixture with warmer air, saturated, or nearly saturated, with moisture (such as that resting on the surface of large bodies of water), and strikingly exemplified in our autumnal and winter fogs, when the water, owing to the heat absorbed during summer, is of a higher temperature than the inflowing air. Dr. Davy, however, refers to another cause, not so much noticed—viz., a mild moist air coming in contact with a colder air, equally humid, resting on cold surfaces, whether of land or water, about the end of winter or beginning of spring. He